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(54) Title: PRODUCT LOADER

(57) Abstract

A product loader moves first and second products from a first station to a second station and has two independent loading units each movable from a first position near the first station to a second position near the second station. Each loading unit can thus move a product from the first station to the second station. A driving mechanism is operable to move the first loading unit and the second loading unit independently of each other between the first and second stations in such a way that each of said first loading unit and said second loading unit does not obstruct the other's movement between the first and second stations. The loader may be used for high speed loading of cartons. Products comprising multiple items may be loaded by units having laterally–spaced pusher fingers. The lateral spacing of the fingers may be variable, so that the spacing between multiple items may be reduced during movement by the loading units.

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Product Loader

Product loading devices and systems are well known and are utilized in many different industries for many different applications. For example, in the packaging industry loaders are used in packaging systems designed for loading multiple items or products into cartons.

By way of example only, in one known packaging system a product loader is employed in combination with several other components, including a carton feeder, product accumulator, a product in-feed conveyor system and a continuous conveyor.

The carton feeder typically comprises a carton magazine, which holds knocked down cartons, and an opening device, usually having a rotatable suction head which operates in cooperation with a fixed suction head. The rotatable suction head grasps a knocked down carton from the carton magazine at a first location, and then rotates to transfer the knocked down carton to a second position in proximity to the fixed suction head device, which operates to engage the rear of the grasped knocked down carton. The rotatable and fixed suction head devices, in cooperation, open the knocked down carton, which is then released by the suction head. Subsequently the rotatable suction head transfers the opened carton onto a conveyor which will translate the carton to a position to receive the product to be packaged.

The product accumulator typically functions to load product serially into buckets and translate the full buckets to an unloading station where, typically, a plurality of buckets unload product simultaneously. The bucket loading station on the product accumulator is usually proximate to the product in-feed conveyor system and the bucket unloading/carton loading station is usually proximate to the product loader and the continuous conveyor. One form of product accumulator has a horizontally translatable table movably mounted on a linear

bearing rail. Mounted at either end of the table, usually along the major axis of the table, are two idlers in the same plane as the table. The idlers engage a chain which surrounds the table and portions of the idlers. Engaging this chain are two independently driven sprockets, a loading sprocket and an unloading sprocket, located at opposite ends of the table. Also engaging the chain are a plurality buckets which are used to carry product from the bucket loading station side of the product accumulator to the bucket unloading/carton loading station side of the product accumulator. The buckets are typically U-shaped allowing product to be transferred into and out of the bucket by pushing the product through the bucket.

A known form of product loader typically comprises a horizontal mounting bar from which a plurality of pushing fingers, for example six, depend vertically from the mounting bar. The mounting bar is translatable in both horizontal and vertical directions. The mounting bar typically has either three or four positions or stations. A first, or standby, position, is located above the bucket unloading/carton loading station and slightly behind the buckets at the bucket unloading/carton loading station of the product accumulator. To unload these buckets the loader moves in a downward direction into a second position where the bottoms of the pusher fingers are in the plane of the bottom of the bucket cavity. The loader then moves horizontally to a third position wherein the fingers are proximate to the plane of the opening of the carton on the continuous conveyor. In some instances the loader moves directly, through an arc, from the third position to the standby position. In other instances the loader moves vertically from the third position into a fourth position. From this fourth position the loading unit translates horizontally back to the standby position. As is obvious from the geometry of the two examples of movement of the loader, the three position motion requires less cycle time.

In operation of the packaging system, the product accumulator receives product from the product in-feed conveyor system, which product is transferred to an empty bucket engaging the chain. Upon receipt of a first product, the loading sprocket is driven to index the loaded bucket one position. Since the unloading sprocket is operated independently of the loading sprocket, the indexing of the bucket causes the entire table, idlers, chains and all buckets engaging the chain to translate on the linear bearing rail. This bucket loading operation is usually carried out continuously.

During the bucket loading operation the bucket unloading/product loading operation is also conducted. During the bucket unloading operation a plurality of buckets, typically up to six buckets, can be unloaded simultaneously. When these buckets are unloaded, the loader operates to push the products from the buckets through a funnel, which reduces the pitch between products, into an awaiting open carton on the continuous conveyor. After unloading the buckets, the loader unit returns to its standby position. The unloading sprocket subsequently operates to index the chain a distance equivalent to the number of buckets unloaded. This indexation will result in the combined movement of the table, and attached components, along the linear bearing rail coupled with the chain rotating about the table and the idlers. The net result is that a new, full complement of loaded buckets is now presented at the bucket unloading/carton loading station.

The operation of the loader is critical to the successful completion of the bucket unloading/carton loading operation. As is understood by those skilled in the art, it is highly desirable to minimize the time required for unloading of the buckets, and therefore loading of opened cartons. It is clearly desirable to move the product from the buckets into the opened carton at a velocity which does not cause any damage to the product. Moreover, it is desirable to allow the loading unit to dwell for a period of time at the opening of the carton while the product

settles so that, when the loaded carton is conveyed away from the carton loading station, the product does fall out of the opened carton.

As the operational speed of a packaging system is increased, the amount of time available to push the product from the loaded buckets into the open carton is reduced. This reduction in available time requires the loader to move at ever increasing velocities. The increased velocity of the loader results in a corresponding increase of the forces on the product which, in many instances, may cause damage to the product. Moreover, an increase in operating speed resulting in reduction in the amount of dwell time at the opening of the carton, such that the dwell time may not be sufficient to permit proper placement of product in the carton. A reduction in dwell time potentially results in an increase in the settling of the product out of the carton when separated from the pusher fingers. This can result in product not being properly situated in the carton and possibly falling out of the carton during transport away from the loading station on the continuous conveyor.

According to one aspect of the invention there is a product loader for moving a first and a second product from a first station to a second station, said loader comprising a first loading unit movable from a first position proximate said first station to a second position proximate said second station to move said first product from said first station to said second station, said first loading unit being thereafter movable from said second station back to said first station; a second loading unit movable independently of said first loading unit from said first position proximate said first station to said second position proximate said second station to move a second product from said first station to said second station, said second loading unit being movable thereafter from said second station back to said first station; and a driving mechanism operable to move said first loading unit and said second loading unit independently of each other between said first and second stations in such manner that each of said first

loading unit and said second loading unit does not obstruct the other's movement between said first and second stations.

According to another aspect of the invention there is provided a product loader loader for moving a first and a second product from a first station to a second station, said loader comprising a first loading unit movable from a first position proximate said first station to a second position proximate said second station to move said first product from said first station to said second station, said first loading unit being thereafter movable from said second station back to said first station; a second loading unit movable independently of said first loading unit from said first position proximate said first station to said second position proximate said second station to move a second product from said first station to said second station, said second loading unit being thereafter movable from said second station back to said first station; a first driving mechanism operable to move said first loading unit between said first and second stations; a second driving mechanism operable independently of said first driving mechanism to move said second loading unit between said first and second stations; and a co-ordinator such that each of said first loading unit and said second loading unit does not obstruct the other's movement between said first and second stations.

According to a further aspect of the invention there is provided a method of moving a first product from a first station to a second station, and thereafter moving a second product from said first station to said second station, said method comprising the steps of:

(a) moving a first product from a product feeding station to a product loading station along a loading path with a first loading unit;

(b) dwelling said first loading unit at said product loading station;

(c) returning said first loading unit from said product loading station to said product feeding station along a return path;

(d) during at least part of the time at least one of step (b) or (c) is being performed, moving a second product from said product feeding station to a product loading station along said loading path with a second loading unit;

(e) dwelling said second loading unit at said product loading station;

(f) returning said second loading unit from said product loading station to said product feeding station along said return path;

in such manner that the movement of each of said first loading unit and said second loading unit along said loading path and said return path does not interfere with the movement of the other.

The product loader may be incorporated in a system for loading cartons further comprising a product feeder operable to feed said first product and then said second product to said first station, and a conveyor operable to move a first carton to and then away from said second station, and thereafter to move a second carton to and then away from said second station.

Although the loader of this invention has particular application for use with packaging systems, particularly carton loading machines, the invention can be employed in many different types of applications where a loader is required to move things from one place to another place.

Reference is hereinafter made, by way of example only, to the accompanying diagrammatic drawings of the preferred embodiment, in which:

Figure 1 is a top plan view of a packaging system suitable for employing a loader;

Figure 2 is a top plan view similar to a part of Figure 1, of a system employing a loader;

Figure 3 is front elevation view at 3-3 in Figure 2;

Figure 4 is a side elevation view at 4-4 in Figure 3;

Figure 5 shows a front, enlarged view of part of the loader of Figures 2, 3 and 4, in isolation;

Figures 5a and 5b are top plan views showing some of the components only of the part of the loader shown in Figure 5;

Figure 5c is a front elevation view similar to Figure 5, showing other features of the same part of the loader;

Figure 6 is a cross sectional view at 6-6 in Figure 5;

Figure 7 is a block diagram of several of the components of the loader of Figures 2, 3 and 4;

Figure 8 is a cycle timing chart of some components of the loader of Figures 2, 3 and 4;

Figures 9a and 9b are position-time charts for the loader of Figures 2, 3 and 4;

Figure 10 is a plan view of part of the system of Figures 2, 3 and 4;

Figure 11 is a front elevation view of part of the system of Figure 10; and

Figure 12 is a view similar to that of Figure 3 with some parts in different operative positions.

In Figure 1a packaging system generally designated 10 has an extended carton magazine 12 which stores a plurality of knocked down cartons (Figure 3), which are retrieved one at a time from the magazine by a carton placement loader 16. The cartons 14 (Figure 3) are then erected and thereafter placed by the carton placement loader 16 into buckets 18 (Figure 3) at a carton placement station 13. Each carton 14 is oriented in a bucket 18 such that it can be loaded with product. The buckets 18 are thereafter each carried in series on a continuous conveyor 20 from the carton placement station 13 through a product loading station 17 where one or more products are loaded into each carton.

Once the carton 14 is filled with product, it is carried downstream in bucket 18 by conveyor 20 for further handling and/or processing.

Continuous conveyor 20 may be constructed in accordance with US patent specification no. 5,266,524, the contents of which are hereby incorporated by reference, to provide for a hesitation at station 17, to enable each bucket 18 to dwell for a period of time at station 17 and so enable a carton carried thereby to be loaded with product by a loader 22 as shown in Figure 2.

A product in-feed conveyor system 26 has, in this case, a two lane, side by side, product conveyor, which feeds products such as packages of granola bars to a product accumulator 24, formed in a known racetrack configuration, and having a series of buckets 39 (Figure 4) which rotate about the racetrack. At the loading station 25, product is fed into each of two buckets 39 respectively aligned with the lanes of the in-fed conveyor system 26. The buckets 39 are then indexed over one position, and another product is fed into each of two buckets at the station 25. The result is that when each bucket 39 leaves the station 25 it will have been loaded with two products, one stacked on top of the other. The first product is delivered to each bucket 39 at the first indexed position, and the second product is delivered to each bucket at the second indexed position.

It will be appreciated that two buckets adjacent to each other, one at the first indexed position, and another at the second indexed position, will be loaded with product simultaneously. Thus, both lanes of in-feed conveyor 26 are continuously feeding products to the accumulator in-feed station. At start-up, to avoid having one bucket loaded with only one product (i.e. the bucket at the second indexed position at start-up), the product destined for that bucket will be removed such that at start-up only the bucket at the first indexed position receives a product.

The buckets 39 filled with two products one on top of the other are then indexed around the racetrack of accumulator 24. A sliding table configuration enables buckets to be loaded two buckets at a time, but be discharged at the unloading station 28, by loader 22, several buckets simultaneously into a single carton in a single operation, thus filling the carton 14 with a plurality of products.

The loader 22 (not shown in Figure 1) is located proximate the product loading station 17 and is adapted to unload products simultaneously from six buckets 39 located and dwelling at unloading station 28, and then load them into a single carton 14 carried by a bucket 18 while stationary at product loading station 17 of conveyor 20.

With particular reference to Figures 3, 4, 5 and 6, loader 22 comprises a first loading unit 30a secured to a first frame portion 33 and a second loading unit 30b secured to a second frame portion 35. First loading unit 30a comprises the same components as second loading unit 30b and accordingly only specific details of loading unit 30b will be described herein. Second loading unit 30b has a loading head 34b which comprises a mounting bar 36b on which are mounted six finger assemblies 38b. Each finger assembly 38b is mounted in such a manner that a plate 42b cannot rotate around mounting bar 36b, but can move to some extent along the longitudinal axis of the bar. Figure 6 is a more detailed, cross sectional view of a representative finger assembly 38b and shows how the assembly has a rail 40b secured to a plate 42b. The rail 40b is mounted on mounting bar 36b by bearings, the positions of each of the assemblies 38b on mounting bar 36b being influenced by compression springs 41b (Figure 5c) mounted in bushings 37b between each of the assemblies. When a compressive load is applied to the assemblies 38b at each end of the mounting bar 36b, the assemblies will move from an overall expanded position to a collapsed position

compressing springs 41b. The purpose of this capacity of the assemblies 38b to collapse under compressive load will be described hereinafter.

Also mounted on each plate 42b of each assembly 38b is a finger 44b having an upper portion 45b and a lower portion 47b. The lower portion 47b of each finger 44b is detachable, so that a suitably designed lower portion 47b can be attached. In this preferred embodiment, each finger 44b is mounted on the plate 42b in such a manner that it is capable of being displaced if the finger 44b has an excessive load applied to it. For example, a product pushed by a finger 44b may become entangled upon part of the machinery such that it cannot be pushed any further. Once the load on the finger 44b reaches a certain limit, the finger will be displaced in partial rotation about the axis of mounting bar 36b, thus enabling the finger to pass by the entangled product. This avoids damage being done to the finger assembly 44 and indeed the entire loader 22.

A reciprocating funnel 50, illustrated in Figures 4, 10 and 11, lies between discharge station 28 and product loading station 17 of conveyor 20. The funnel 50 has a base and outside side wall, along with interior channel walls, and is adapted to guide products sitting on the base, each pushed by a finger 44b from the wide funnel entrance to the narrower funnel exit through a channel in the direction of the arrows in Figure 10. The purpose of the funnel 50 is to reduce the spacing, or pitch, between adjacent products, so that when the product reaches the carton 14 , the total transverse width of the packages together is no larger than, and preferably slightly smaller than the carton opening, thus allowing the products to be pushed by the loader into the carton 14. Each of the cartons 14 has flaps at the carton opening which are in an outwardly open position as they approach product loading station 17. To allow the carton flaps to pass by the front end of funnel 50, the funnel must be slightly withdrawn from the vertical front plane or crease line of the carton opening. Once a carton 14 is in a stationary loading position at product loading station

17, the funnel 50 can be brought forward to its fullest extent, aligned with the front edge of the carton 14. This is accomplished by mounting the funnel 50 for sliding on rails and driven by a cam and cam follower system controlled by a programmable controller (PLC) 60 (Figure 7). The specific forward and backward movement of the funnel 50 over time, in relation to the movement of the first loading head 34a and second loading head 34b, is illustrated in the cycle timing chart in Figure 8.

Each of loading heads 34a and 34b is mounted in the same manner, each at one of its ends, on a path defining and driving mechanism comprising several components. For brevity, only the loading head 34b is described and illustrated particularly in Figure 4. The mounting of loading head 34a is opposite to the mounting of loading head 34b, with both loading heads 34a and 34b being mounted inwardly facing.

Loading head 34b has two independent driving and carrying mechanisms: one for the up/down direction or y axis orientation; the other for the backwards/forward direction or x axis orientation. The x axis mechanism 52b is fixed in the y direction relative to the frame. The loading head 34b is mounted on the y axis mechanism 54b, which in turn is mounted on the x axis mechanism 52b. Thus the loading head 34b can be moved up and down in the y axis direction, relative to the y axis mechanism 54b. The y axis mechanism 54b is itself driven by the x axis mechanism 52b, thus providing, indirectly, movement of the loading head 34b backwards and forwards in the x direction.

With particular reference to Figure 4, the x-axis mechanism 52b is fixedly attached to frame portion 35, and comprises a rigid horizontal cantilever 70b which has a recessed horizontal linear bearing (not shown) extending along substantially the entire length of cantilever 70b. Translatably mounted on cantilever 70b and engaging the horizontal linear bearing is vertical cantilever 80b of y-axis mechanism 54b. As described above, y-axis mechanism 54b can

translate along the horizontal axis by means of the linear bearing and is driven by way of a belt 72b (shown in dotted outline). Belt 72b is wrapped about idler 74b (rotatably mounted proximate to one end of cantilever 70b) and servo drive motor 76b (mounted proximate to the other end of cantilever 70b). Belt 72b is engaged by belt clamp 78b which is fixedly attached to vertical cantilever 80b. The operation of the servo drive motor 76b is controlled by PLC 60 (Figure 7).

Vertical cantilever 80b houses a recessed vertical linear bearing (not shown), which extends substantially the entire length of cantilever 80b. Translatably mounted on vertical cantilever 80b is second loading head 34b. Second loading head 34b is translatable along the y-axis by way of the vertical linear bearing. Second loading head 34b is translated along the y-axis through the operation of piston assembly 82b (Figure 3). Piston assembly 82b is controlled, via cabling 84b and 86b, by PLC 60 (Figure 7). By pressurizing the piston chamber 88b, piston 90b is driven downwards driving second loading unit 32. De-pressurizing piston chamber 84b returns piston 90b to a housed position lifting second loading unit 32 upwards.

Referencing Figure 12, first and second loading units 30a and 30b are illustrated with cam plates 92a and 92b. Cam plates 92a and 92b define a channel which narrows in the horizontal plane from its rearward opening proximate the rear of buckets 29 at discharge station 28 to its narrowest opening proximate the opening of carton 14 on continuous conveyor 20. Cam plates 92a and 92b are fixedly mounted to frame portions 33 and 35, respectively, and operate on first and second loading units 34a and 34b.

Each of the loading heads 34a and 34b travels a common, closed path, but their positions on that closed path at any point in time are different. This closed path is generally rectangular in shape. The starting point of this path can be taken as a bottom corner of the rectangle (see for example position I of 34b in Figure 4) at which point the fingers 44 are positioned behind the products to

be discharged from the buckets 39 on the accumulator 24 at discharge station 28. With reference to the cycle timing chart in Figure 8, the first loading head 34a (referred to in Figure 8 as "loader one") moves horizontally forward from behind the buckets 39 located at discharge station 28, passing through the openings in buckets 39 to dislodge the products therefrom, and thereafter moving them into and through funnel 50. As funnel 50 narrows, a compressive load is applied indirectly by cam plates 92a, 92b (Figure 12) to the finger assemblies 38a, progressively urging them inwards to correspond with the narrowing of the funnel and consequent reduction in lateral spacing of the products. The finger assemblies 38a, 38b are thus compressed from their fully expanded positions shown in Figure 5b to the maximum collapsed positions shown in Figure 5a.

As illustrated in Figure 12, first loading head 34a is shown with finger assemblies 38a on mounting bar 36a in their uncompressed form. That is, the pitch between finger assemblies 38a is at its greatest. Finger assemblies 38b are shown proximate discharge station 28 about to be compressed by cam plates 92a,92b as it moves forward toward the opening of carton 14. As second loading head 34b (referred to as "loader two" in Figure 8) moves from behind buckets 39 to a position proximate the opening of carton 14, cam plates 92a and 92b impart an inwardly compressive force along the axis of mounting bar 36b on finger assemblies 38b in the same way as previously described with reference to finger assemblies 38a. Following the dwell at the opening of carton 14, second loading head 34b is moved upwards and the compressive force on finger assemblies 38b is relieved and compression springs 41b located on mounting bar 36b impart an outward expansive force on finger assemblies 38b increasing the pitch between these assemblies to allow them to return to their initial positions.

The control mechanism for the loader 22 is illustrated in Figure 7. PLC 60 controls both funnel 50 and the loading units 30a and 30b. Referencing Figures 8, 9a and 9b, the first loading head 34a will be driven horizontally forward by the x axis mechanism 52a for about 0.6 seconds to the opposite, bottom forward corner of its rectangular path (corresponding to the position of 34b indicated at II in Figure 4), at which position the products will have been pushed into a waiting carton 14. As may be noted from the timing chart, the first loading head 34a will dwell at this position for about 0.1 second to allow the product time to settle in the carton. Thereafter the first loading head 34a will be driven upward by the y axis mechanism 54a for a period of about 0.35 seconds to a position at the upper forward corner of the rectangular path. Thereafter, the first loading head 34a (together with the y axis mechanism 54a) will be driven backwards and horizontally by the x axis mechanism 52a for a period of about 0.35 seconds, after which it will have reached the upper rear corner of the rectangular path. Finally, to complete its rectangular closed path, the y axis mechanism 54a will move the first loading head 34a downward for a period of about 0.4 seconds until it reaches the initial starting position, at the bottom rear corner of the rectangular path. It will be noted that in the forward horizontal motion, the first loading head 34a took 0.6 seconds to cover the horizontal distance while taking only about 0.35 seconds during the backward horizontal motion. Thus the servo drive motor 76a driving the x axis mechanism 52a can vary its speed, having a slower speed when the loading head 34a is pushing product to a carton 14, and a faster speed when moving horizontally backwards.

The second loading head 34b follows the same path as first loading head 34a, but at any point in time, it is located at a different position on the closed path from first loading head 34a. From Figure 8 it will be noted that the second loading head 34b, driven by its respective x axis mechanism 52b, commences its

horizontal movement forward from the start point at the bottom rear corner of the rectangular path, about 1 second after the first loading head 34a started its forward horizontal movement from the same position. At the time the second loading head 34b is commencing its forward horizontal movement, the first loading head is already well into its upward movement toward the upper forward corner of the rectangular path, driven by its respective y axis mechanism (54b). By the time the first loading head 34a has finished its horizontal rearward movement, the second loading head 34b will not yet have completed its forward horizontal movement.

As mentioned above, funnel 50 moves backwards and forwards in an x axis orientation. As will be noted from the cycle timing chart in Figure 8, when first loading head 34a is at the bottom rearward position of the rectangular path, the funnel 50 is at its most rearward position. Shortly after first loading head 34a has started moving forward and has pushed the products on to the funnel 50, the funnel 50 will start moving forward and will reach its fully forward position before the first loading head 34a reaches its fully forward position. By the time the funnel 50 is at its fully forward position, a bucket 18 will already be in position with an open carton 14 at the product loading station 17. Thus the funnel 50 will not interfere with the movement of bucket 18 into position to receive product into carton 14.

Once at its fully forward position, the funnel 50 will dwell for a short time, to permit the first loading head 34a to deliver product to the open carton 14. More or less contemporaneously with first loading head 34a commencing its dwell at its fully forward bottom position, funnel 50 commences its return movement to its fully rearward position. Thus by the time bucket 18 moves away from the product loading station, the funnel 50 has cleared the station, and will not impede the carton's movement in bucket 18.

Once at its fully rearward position again, funnel 50 has a small dwell time, at which point it repeats the above cycle. This cycle, however, takes place in cooperation with second loading head 34b, which by then has taken the place of first loading head 34a.

The movement of each of the first loading head 34a, second loading head 34b and funnel 50, as described above, is repeated, thus providing for continuous loading of products into buckets 18 which arrive at station 17 on continuous conveyor 20.

It will be appreciated, that as a result, loading head 34a is not fixed in its relative distance to loading head 34b along the length of the closed path. Thus the relative position of one loading unit is independent of the position of the other along the path.

The independent movement of each of the first loading head 34a and second loading head 34b and the funnel 50 is controlled and coordinated by the PLC 60. The PLC is programmed to control and coordinate the speed of each of the loading heads independently of each other and ensures that the heads do not come into contact with each other as they both travel about the same closed path. Of course, the movement of buckets 39 around racetrack accumulator 24 from loading station 25 to discharge station 28, the movement of the loading heads 34a, 34b to transfer the products from those buckets 39 to the cartons 14 in buckets 18 of conveyor 20, and the movement of the buckets 18 to and from the product loading station 17 is synchronized to provide for continuous flow of product from the buckets 39 of accumulator 24 into the cartons 14 carried by buckets 18.

Various modifications can be made within the scope of the invention. For example, it would be possible to provide for one or more additional loading units, operable independently of the other two loading units.

In addition to being independent in terms of the relative distance apart along the path, the loading heads could alternatively, or additionally, be independent of each other in terms of the timing of the heads around the path (i.e. the make-up of their timing cycles). For example, in the timing cycle of Figures 8, 9a and 9b, the timing cycle of first loading head 34a is the same, but phase shifted, when compared to the timing cycle of second loading head 34b. It would be possible to vary the timing cycle itself, of one of the loading heads, independently, when compared relative to the other loading head.

Claims

1. A product loader for moving a first and a second product from a first station to a second station, said loader comprising:

a first loading unit movable from a first position proximate said first station to a second position proximate said second station to move said first product from said first station to said second station, said first loading unit being thereafter movable from said second station back to said first station;

a second loading unit movable independently of said first loading unit from said first position proximate said first station to said second position proximate said second station to move a second product from said first station to said second station said second loading unit being thereafter movable from said second station back to said first station; and

a driving mechanism operable to move said first loading unit and said second loading unit independently of each other between said first and second stations in such manner that each of said first loading unit and said second loading unit does not obstruct the other's movement between said first and second stations.

2. A product loader for moving a first and a second product from a first station to a second station, said loader comprising:

a first loading unit movable from a first position proximate said first station, to a second position proximate said second station to move said first product from said first station to said second station, said first loading unit being thereafter movable from said second station back to said first station;

a second loading unit movable independently of said first loading unit from said first position proximate said first station to said second position proximate said second station to move a second product from said first station to said second station, said second loading unit being thereafter movable from said second station back to said first station;

a first driving mechanism operable to move said first loading unit between said first and second stations;

a second driving mechanism operable independently of said first driving mechanism to move said second loading unit between said first and second stations; and

a co-ordinator such that each of said first loading unit and said second loading unit does not obstruct the other's movement between said first and second stations.

3. A product loader as claimed in claim 1 or claim 2, comprising a PLC to control the movement of said loading units between the first station and the second station.

4. A product loader as claimed in any preceding claim, wherein the or each driving mechanism comprises a PLC to drive each of said first loading unit and said second loading unit in a closed path.

5. A product loader as claimed in any preceding claim 5, wherein each of said first and said second loading units follow a common closed path.

6. A product loader as claimed in claim 5, wherein the closed path is generally rectangular in configuration.

7. A product loader as claimed in claim 5 or claim 6, wherein each of said first loading unit and said second loading unit has a loading head which moves about said common closed path.

8. A product loader as claimed in claim 7, wherein each of said loading heads has at least one finger protruding therefrom, said finger being adapted to engage a product situated at said first station and to move said product from said first station to said second station.

9. A product loader as claimed in claim 8, wherein each of said loading heads comprises a plurality of laterally-spaced fingers for engaging and moving products comprising multiple items along generally parallel paths from said first station to said second station.

10. A product loader as claimed in claim 9, further including guide means for products moved by said loading heads from said first station to said second station, said guide means including a plurality of channels defining slightly converging paths for said products.

11. A product loader as claimed in claim 10, including means synchronised with said respective drive means for cyclically moving said guide means between said first and second stations, whereby said guide means is advanced towards said second station with said respective loading unit and thereafter retracted.

12. A product loader as claimed in claim 9 or claim 10, wherein said laterally-spaced fingers are relatively movable so that their respective spacing is variable.

13. A product loader as claimed in any preceding claim, wherein each of said first loading unit and said second loading unit follows a common closed path, said driving mechanism or mechanisms being operable to move said

loading units around said path such that their mutual spacing differs around said path.

14. A product loader as claimed in any preceding claim, wherein the or each driving mechanism includes, for each of said first and second loading units, separate moving mechanisms operating along substantially perpendicular axes.

15. A system for loading cartons with a first product and a second product comprising a product loader as claimed in any preceding claim, and further comprising a product feeder operable to feed said first product and then said second product to said first station, and a conveyor operable to move a first carton to and then away from said second station, and thereafter to move a second carton to and then away from said second station.

16. A system as claimed in claim 15, wherein said product feeder is operable to continuously feed product to said first station, said conveyor is a continuous conveyor operable to continuously move a plurality of buckets each carrying a carton to be loaded with at least one product to and then away from said second station, and said loader is operable to continuously move said first and second loading units between said first station and said second station, to continuously load said cartons carried by said plurality of buckets with at least one product.

17. A method of moving a first product from a first station to a second station, and thereafter moving a second product from said first station to said second station, said method comprising the steps of:

(a) moving a first product from a product feeding station to a product loading station along a loading path with a first loading unit;

(b) dwelling said first loading unit at said product loading station;

(c) returning said first loading unit from said product loading station to said product feeding station along a return path;

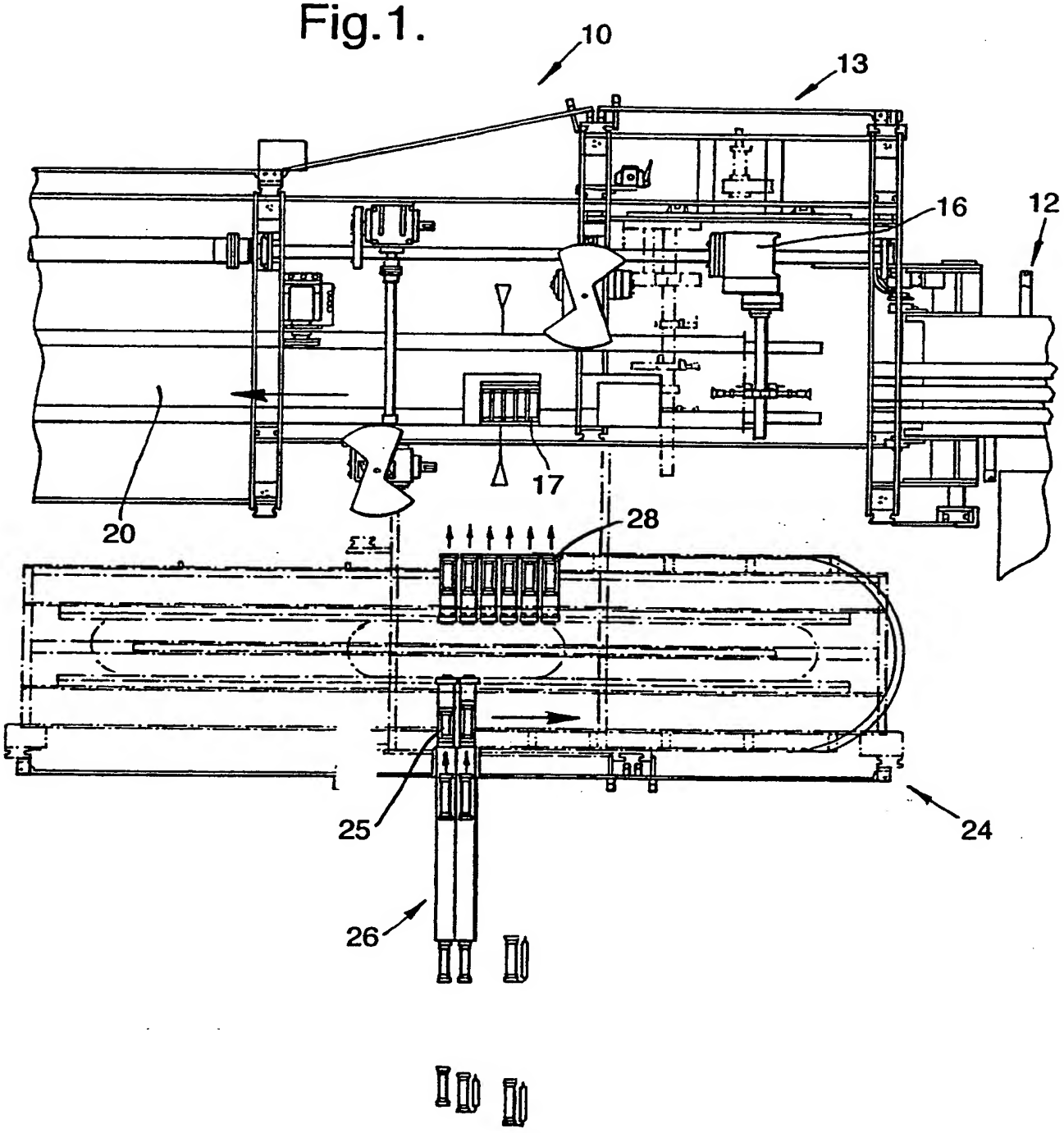
(d) during at least part of the time at least one of step (b) or (c) is being performed, moving a second product from said product feeding station to a product loading station along said loading path with a second loading unit;

(e) dwelling said second loading unit at said product loading station;

(f) returning said second loading unit from said product loading station to said product feeding station along said return path;

in such manner that the movement of each of said first loading unit and said second loading unit along said loading path and said return path does not interfere with the movement of the other.

Fig.1.



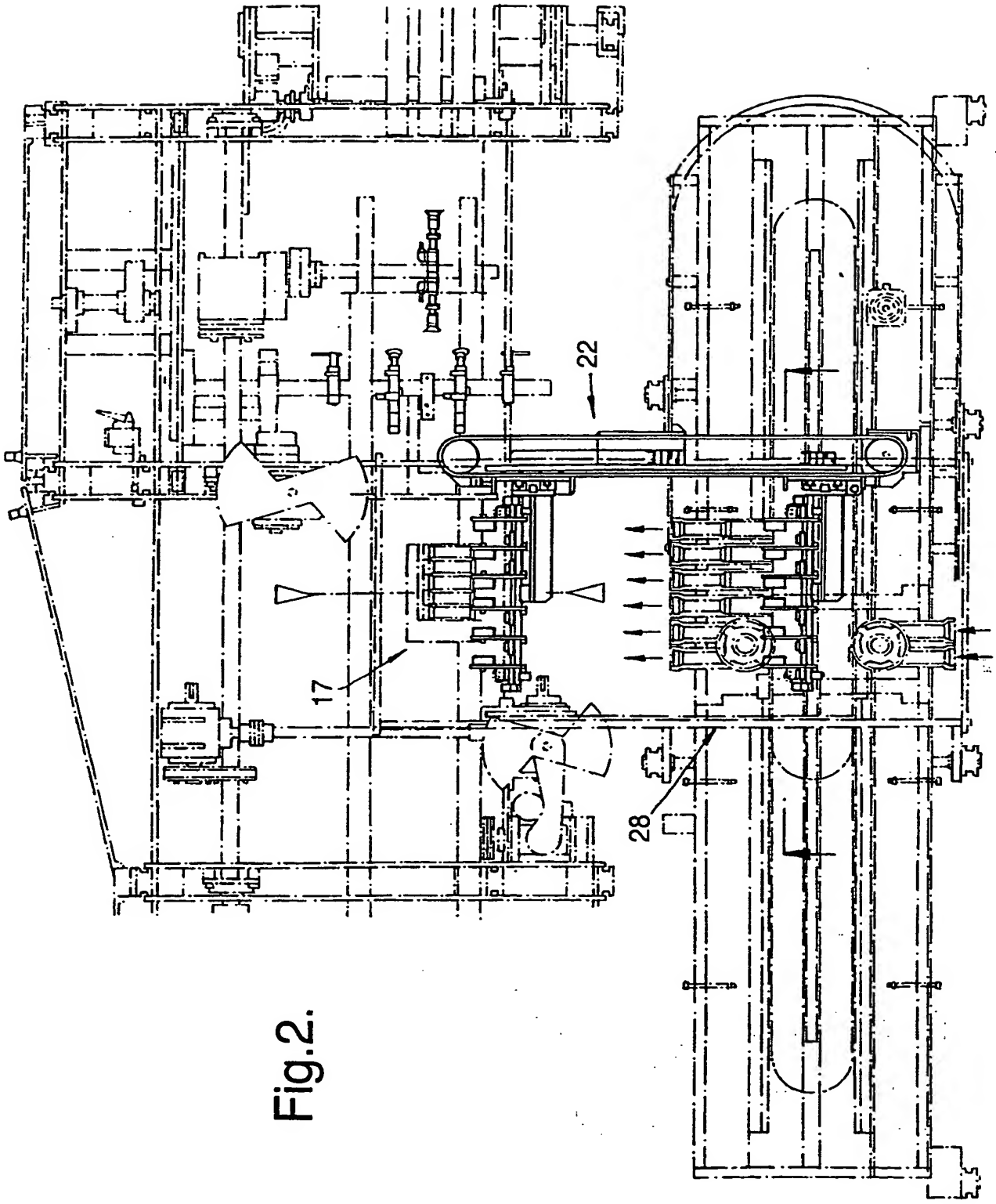
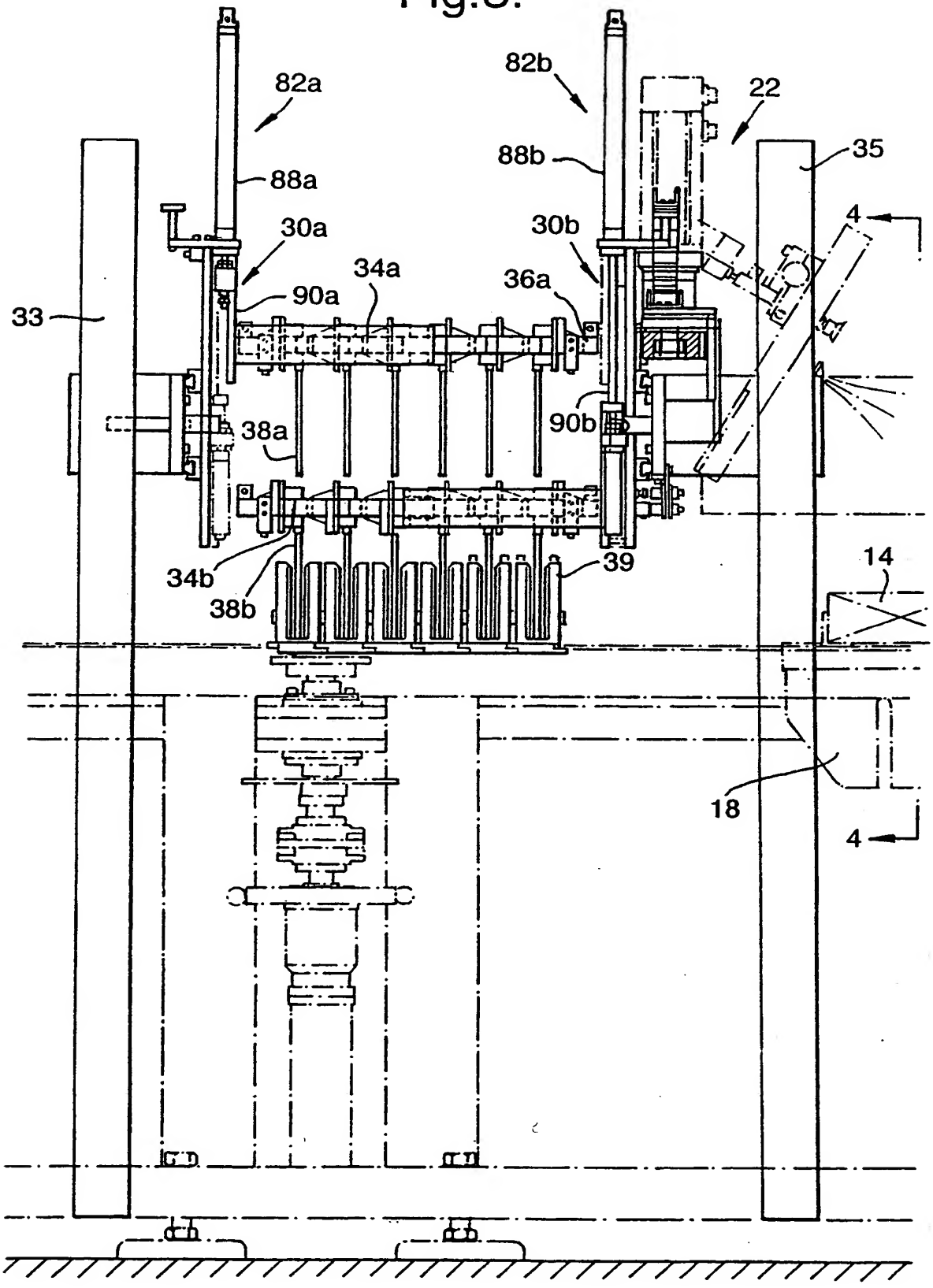


Fig.2.

Fig.3.



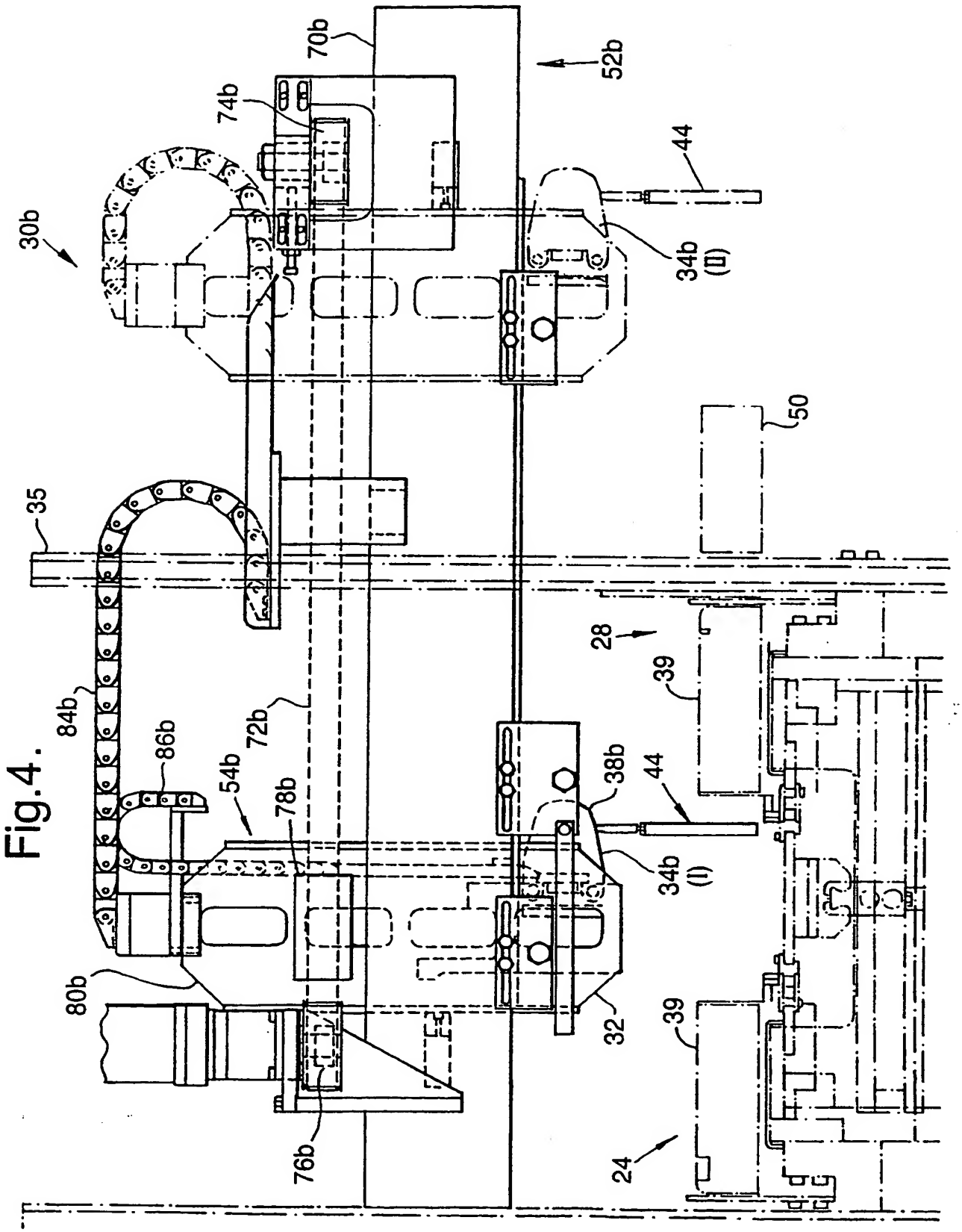


Fig.4.

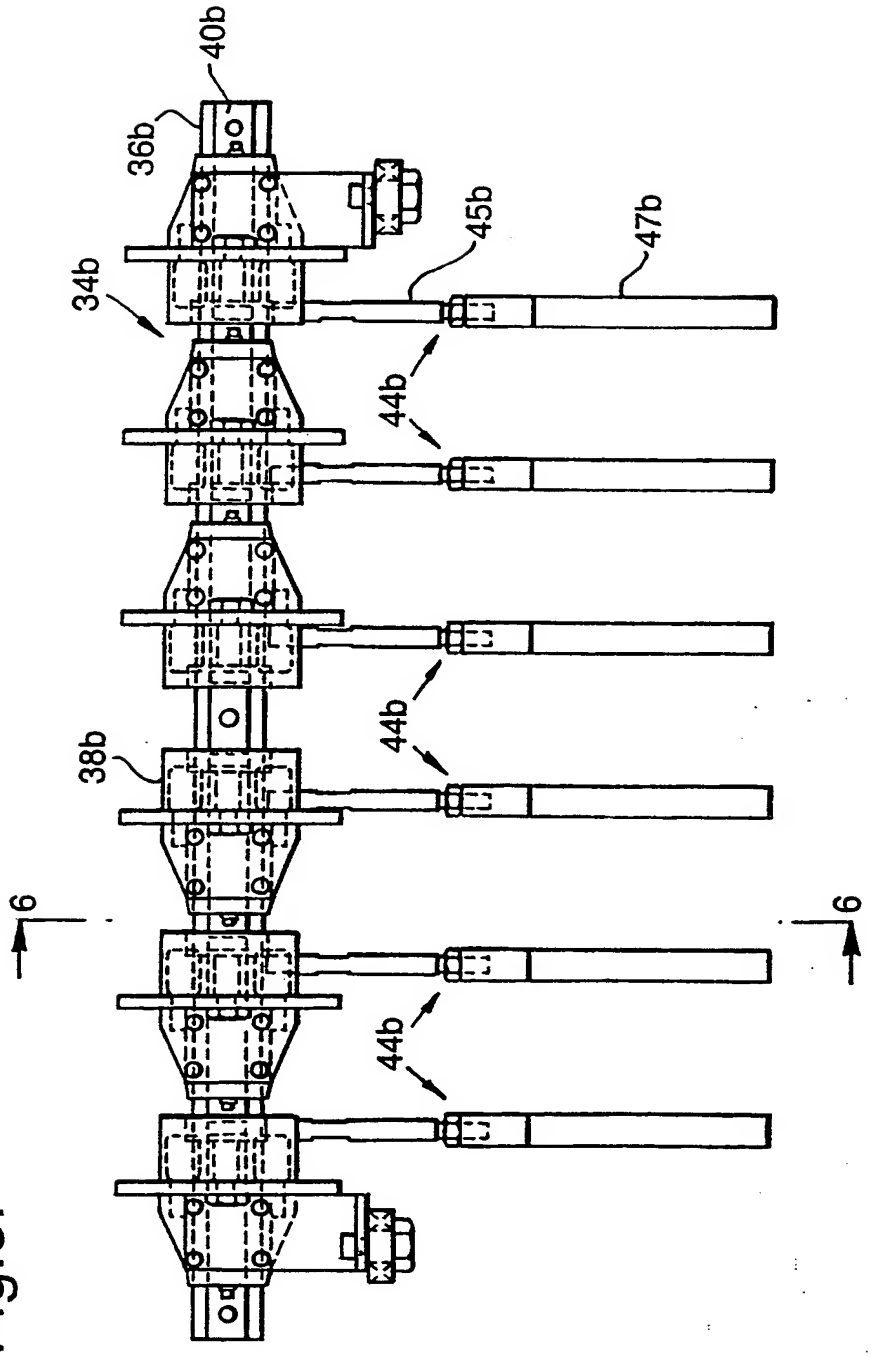


Fig.5.

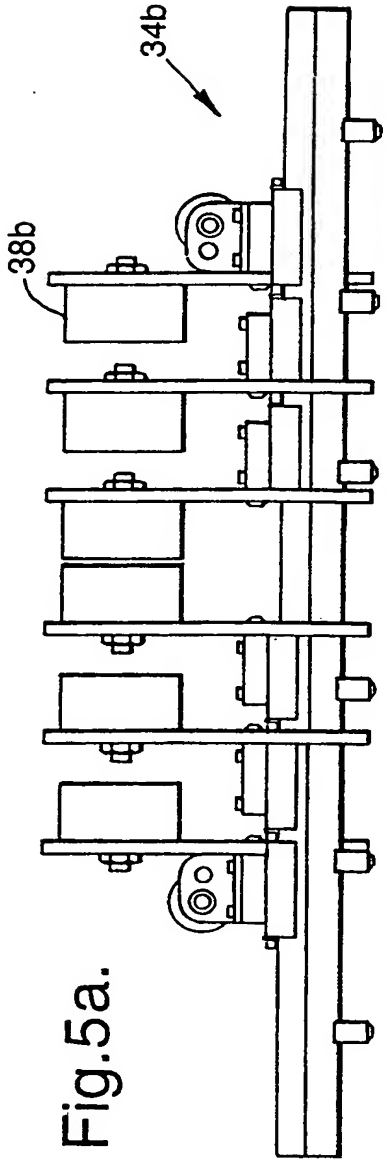


Fig.5a.

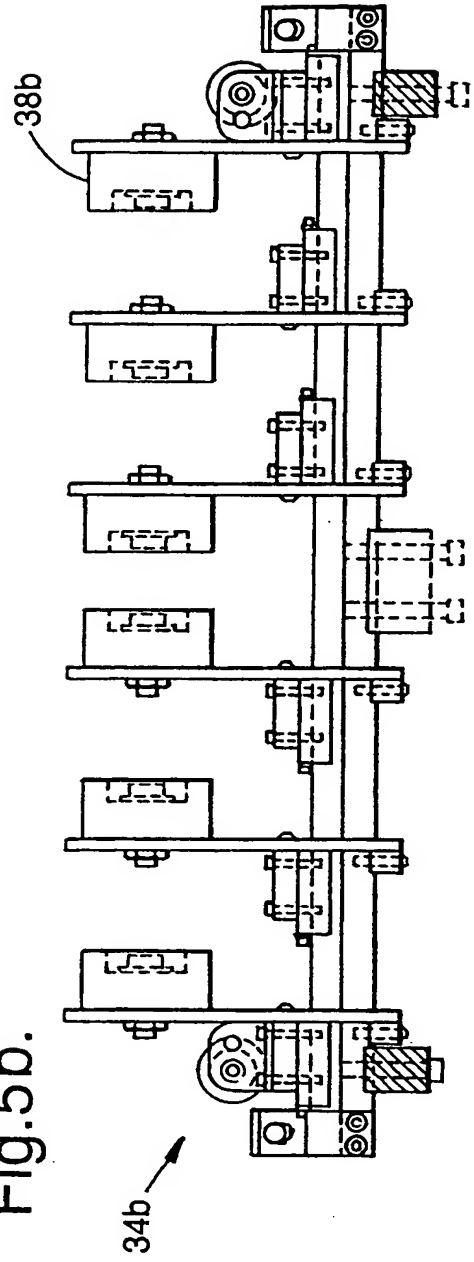


Fig.5b.

Fig.5c.

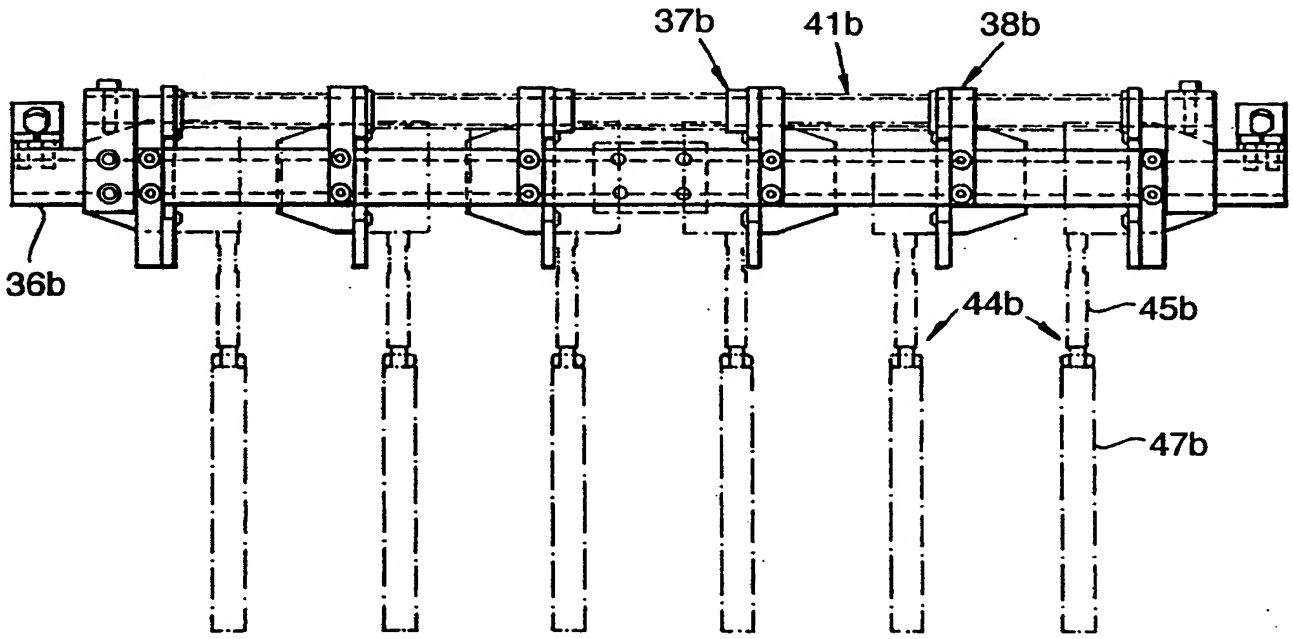


Fig.6.

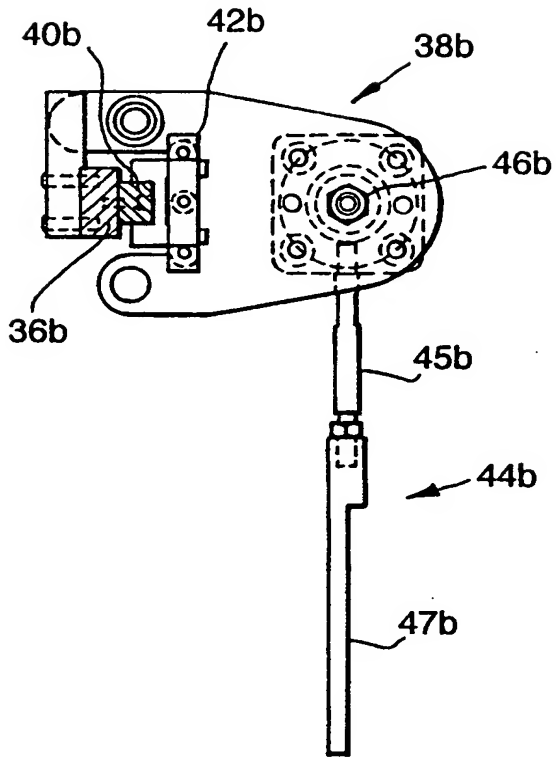


Fig.7.

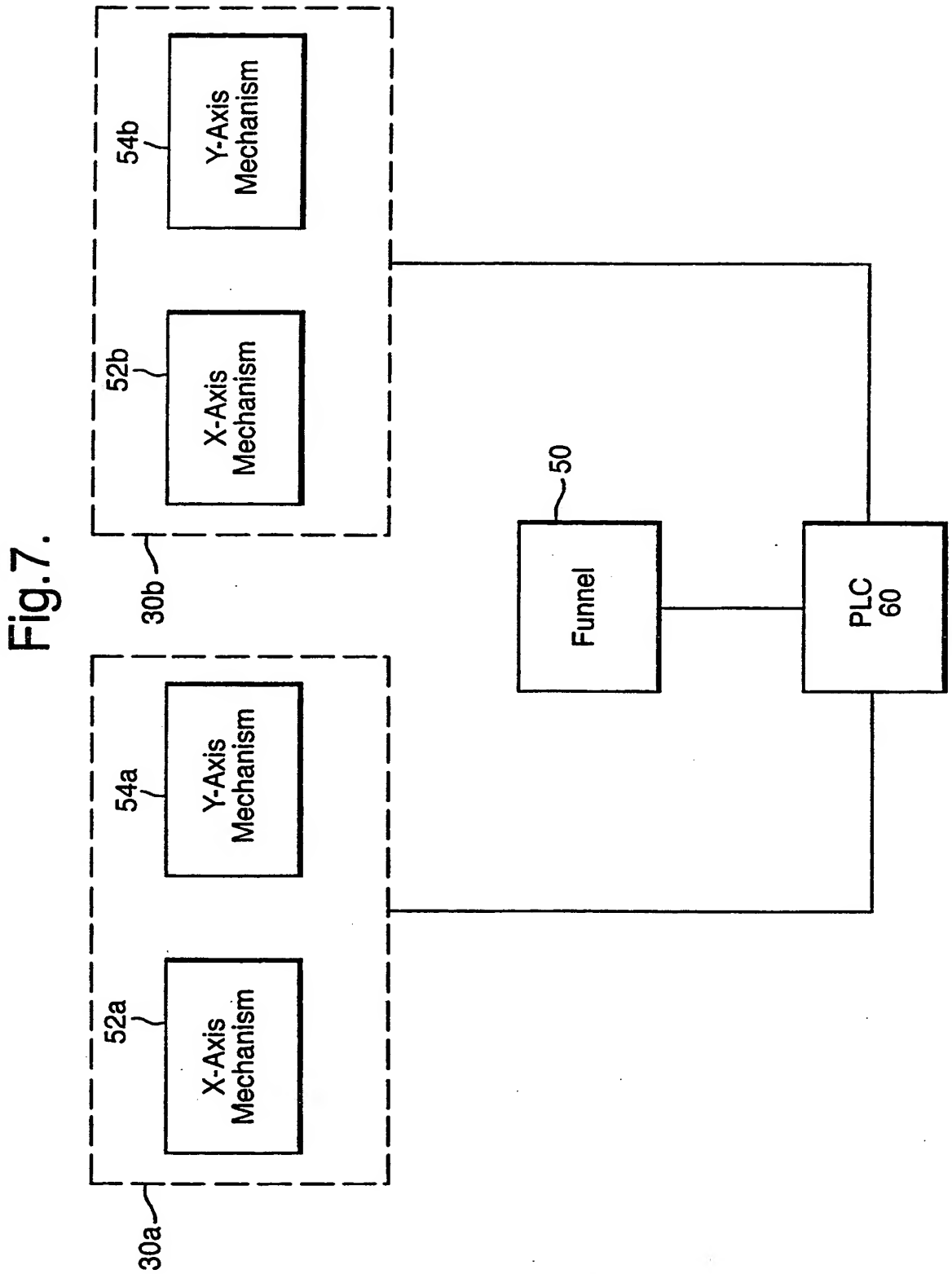

54b
Y-Axis Mechanism
52b
X-Axis Mechanism
30b
50
Funnel
PLC 60
54a
Y-Axis Mechanism
52a
X-Axis Mechanism
30a

Fig.8.

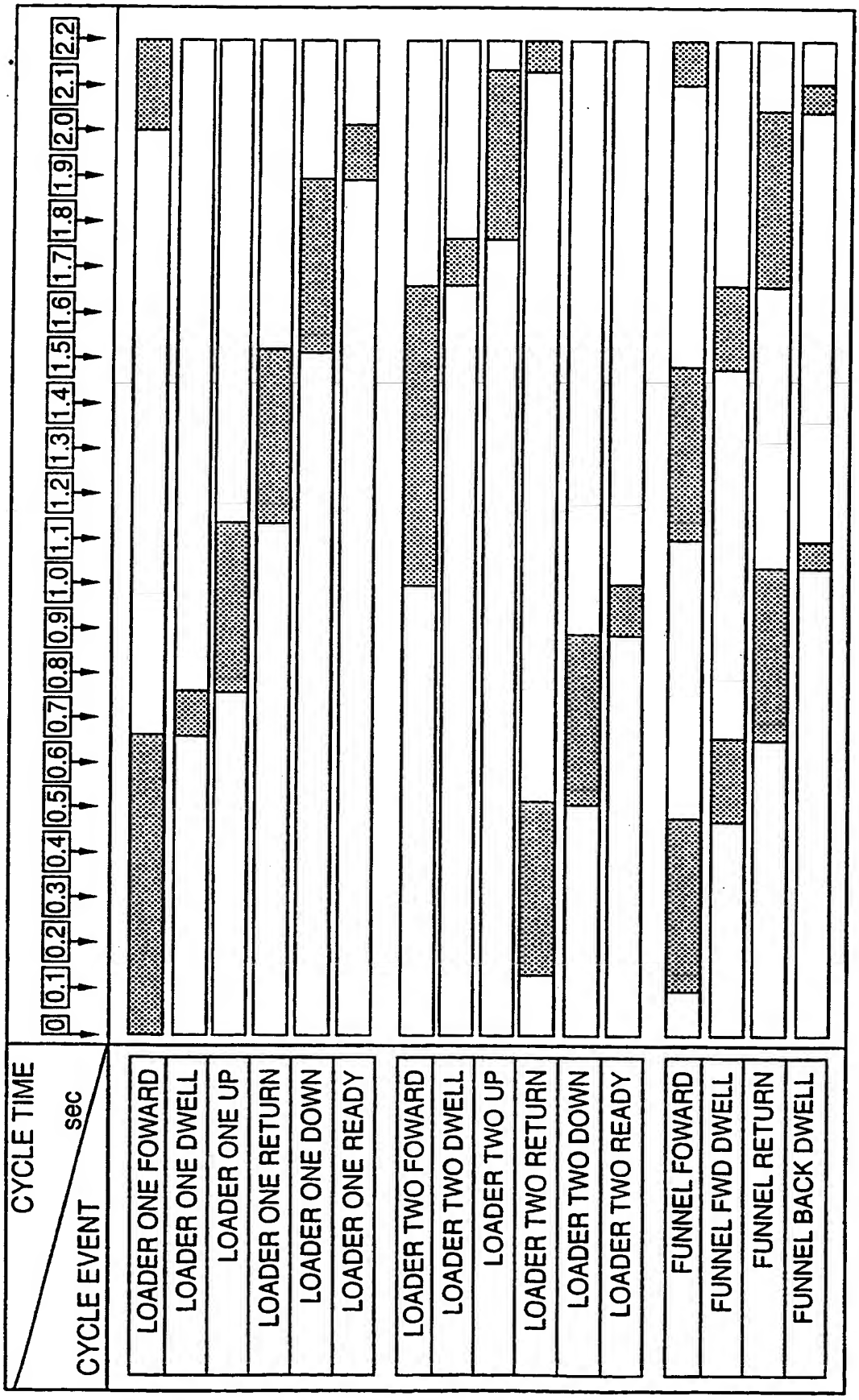


Fig.9a.

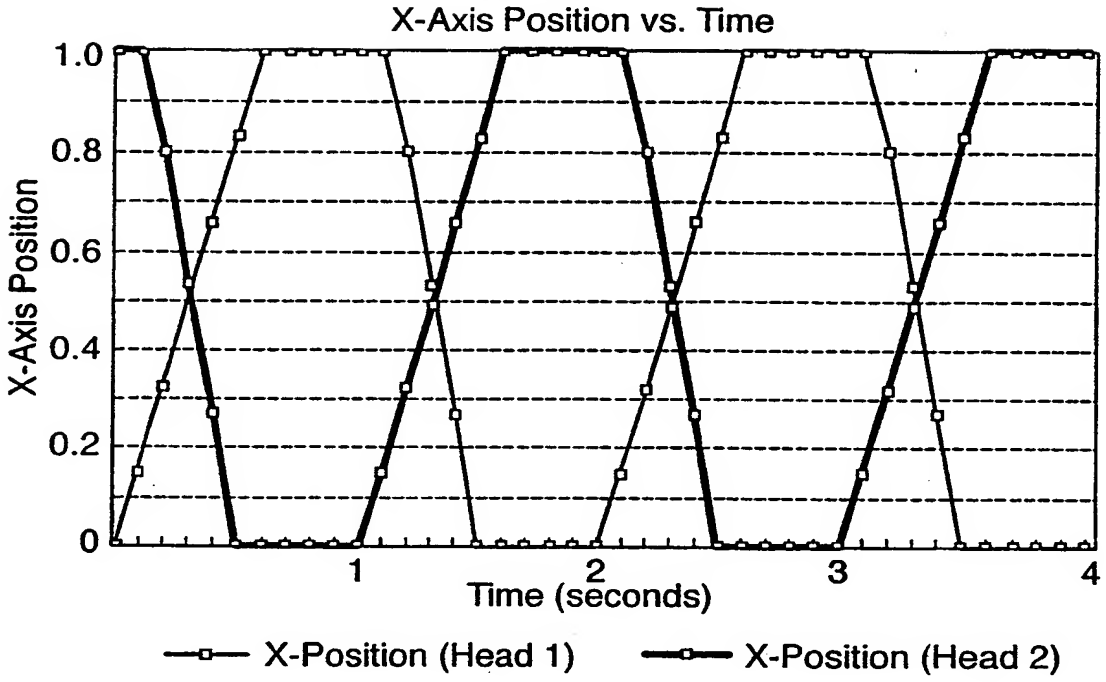


Fig.9b.

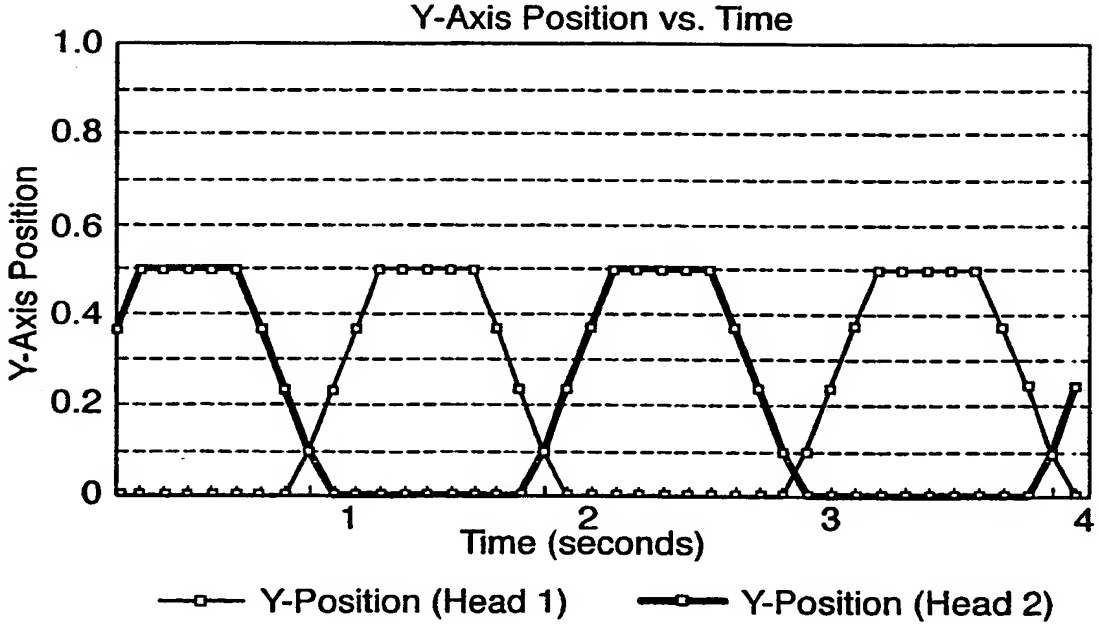


Fig.10.

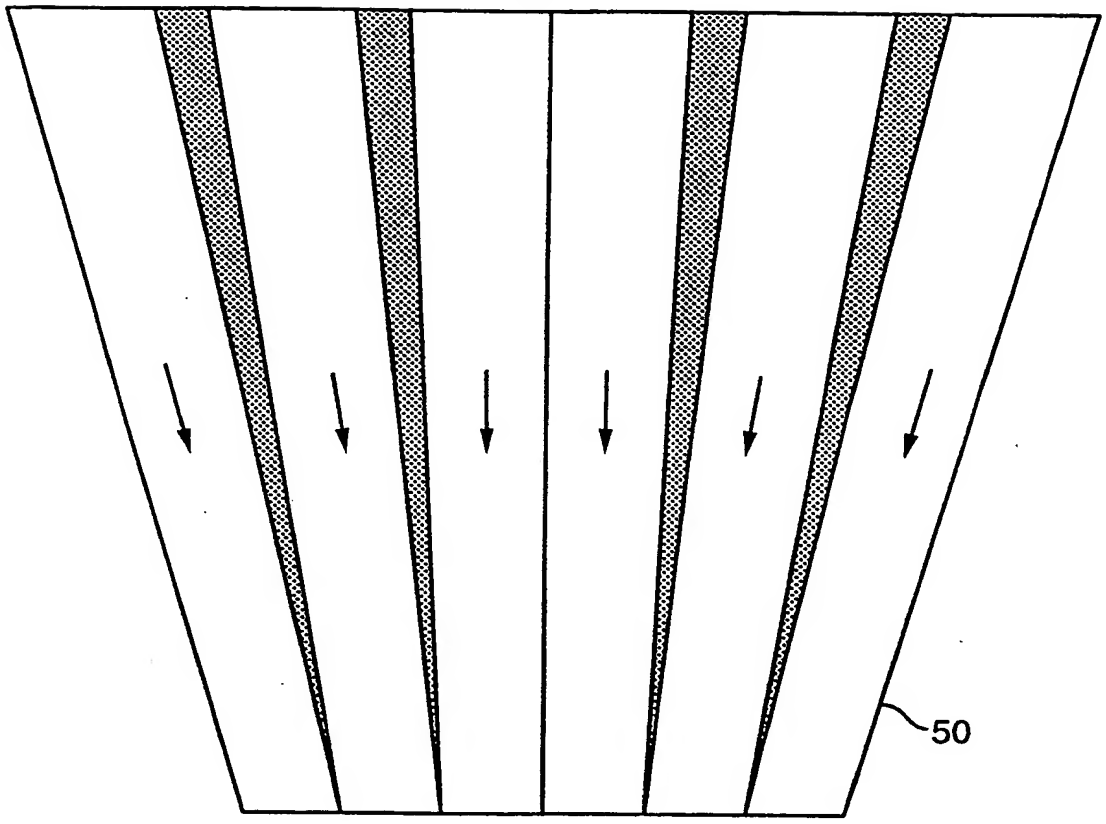


Fig.11.

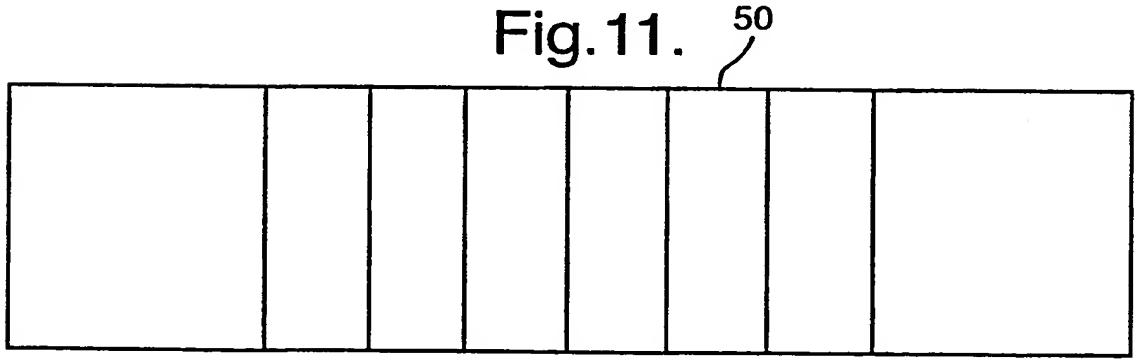
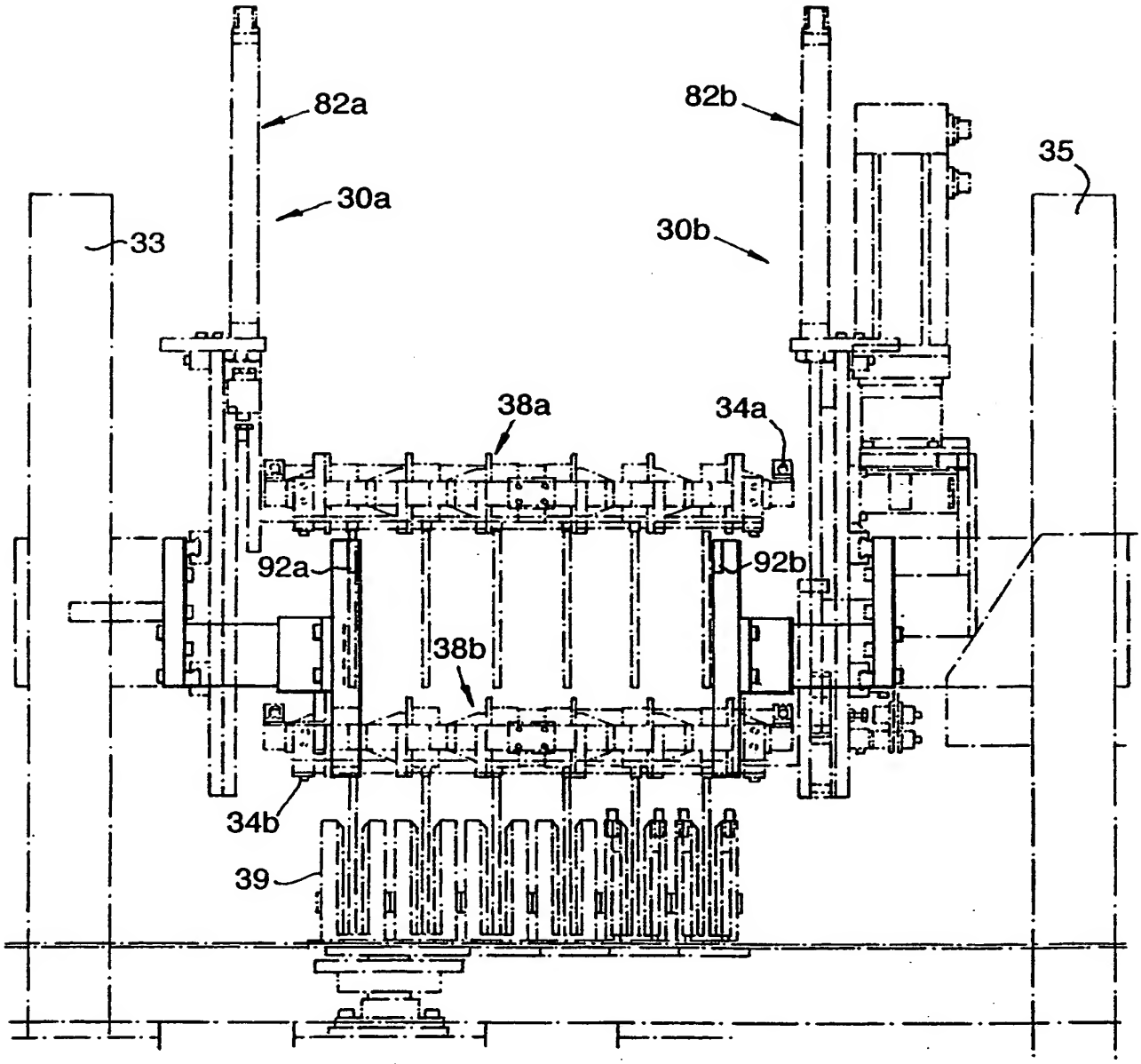


Fig.12.



INTERNATIONAL SEARCH REPORT

Intern ıal Application No
PCT/GB 99/02520

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65B5/06 B65G47/82 B65G47/84 B65B35/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65B B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 5 127 209 A (HUNTER) 7 July 1992 (1992-07-07) abstract column 3, line 26 -column 5, line 57; figures 1-8	1,2,5, 7-9,17 14-16
Y	US 5 176 244 A (RADZINS) 5 January 1993 (1993-01-05) abstract; figures 1,2 column 4, line 41 -column 5, line 13	14
Y	US 3 269 091 A (BARTELT) 30 August 1966 (1966-08-30) the whole document	15,16
A	DE 12 02 711 B (BROTHERS) 7 October 1965 (1965-10-07) figure 3	10

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 November 1999	19/11/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Claeys, H

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern ıal Application No
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